One sees clearly why one gets a musical note: the noise of the spark is due to a sudden heating of the air; now if the heat is oscillatory, the sound will be oscillatory too, but both will be an octave above the electric oscillation, if I may so express it, because two heat-pulses will accompany every complete electric vibration, the heat production being independent of direction of current.

Having thus got the frequency of oscillation down to so manageable a value, the optical analysis of it presents no difficulty: a simple looking-glass waggled in the hand will suffice to spread out the spark into a serrated band, just as can be done with a singing or a sensitive flame, a band too of very much the same appearance.

Using an ordinary four-square rotating mirror driven electromagnetically at the rate of some two or three revolutions per second, the band is at the lowest pitch seen to be quite coarsely serrated; and fine serrations can be seen with four revolutions per second in even the shrill whistling sparks.

The only difficulty in seeing these effects is to catch them at the right moment. They are only visible for a minute fraction of a revolution, though the band may appear drawn out to some length. The further away a spark is from the mirror, the more drawn out it is, but also the less chance there is of catching it.

With a single observer it is easy to arrange a contact maker on the axle of the mirror which shall bring on the discharge at the right place in the revolution, and the observer may then conveniently watch for the image in a telescope or opera-glass, though at the lower pitches nothing of the kind is necessary.

But to show it to a large audience various plans can be adopted. One is to arrange for several sparks instead of one; another is to multiply images of a single spark by suitably adjusted reflectors, which if they are concave will give magnified images; another is to use several rotating mirrors; and indeed I do use two, one adjusted so as to suit the spectators in the gallery.

But the best plan that has struck me is to combine an intermittent and an oscillatory discharge. Have the circuit in two branches, one of high resistance so as to give intermittences, the other of ordinary resistance so as to be oscillatory, and let the mirror analyze every constituent of the intermittent discharge into a serrated band. There will thus be not one spark, but a multitude of successive sparks, close enough together to sound almost like one, separate enough in the rotating mirror to be visible on all sides at once.

But to achieve it one must have great exciting power. In spite of the power of this magnificent Wimshurst machine, it takes some time to charge up our great Leyden battery, and it is tedious waiting for each spark. A Wimshurst does admirably for a single observer, but for a multitude one wants an instrument which shall charge the battery not once only but many times over, with overflows between, and all in the twinkling of an eye.

To get this I must abandon my friend Mr. Wimshurst, and return to Michael Faraday. In front of the table is a great induction coil; its secondary has the resistance needed to give an intermittent discharge. The quantity it supplies at a single spark will fill our jars to overflowing several times over. The discharge circuit and all its circumstances shall remain unchanged. [Excite jars by coil.]

Running over the gamut with this coil now used as our exciter instead of the Wimshurst machine—everything else remaining exactly as it was—you hear the sparks give the same notes as before, but with a slight rattle in addition, indicating intermittence as well as alternation. Rotate the mirror, and everyone should see one or other of the serrated bands of light at nearly every break of the primary current of the coil. [Rotating mirror to analyze sparks.]

The musical sparks which I have now shown you were obtained by me during a special digression[1] which I made while examining the effect of discharging a Leyden jar round heavy glass or bisulphide of carbon. The rotation of the plane of polarization of light by a steady current, or by a magnetic field of any kind properly disposed with respect to the rays of light, is a very familiar one in this place. Perhaps it is known also that it can be done by a Leyden jar current. But I do not think it is; and the fact seems to me very interesting. It is not exactly new—in fact, as things go now it may be almost called old, for it was investigated six or seven years ago by two most highly skilled French experimenters, Messrs. Bichat and Blondlot.

But it is exceedingly interesting as showing how short a time, how absolutely no time, is needed by heavy glass to throw itself into the suitable rotatory condition. Some observers have thought they had proved that heavy glass requires time to develop the effect, by spinning it between the poles of a magnet and seeing the effect decrease; but their conclusions cannot be right, for the polarized light follows every oscillation in a discharge, the plane of polarization being waved to and fro as often as 70,000 times a second in my own observation.

Very few persons in the world have seen the effect. In fact, I doubt if anyone had seen it a month ago except Messrs. Bichat and Blondlot. But I hope to make it visible to most persons here, though I hardly hope to make it visible to all.

Returning to the Wimshurst machine as exciter, I pass a discharge round the spiral of wire inclosing this long tube of CS_2, and the analyzing Nicol being turned to darkness, there may be seen a faint—by those close to not so faint, but a very momentary—restoration of light on the screen at every spark. [CS_2 tube experiment on screen.]

Now I say that this light restoration is also oscillatory. One way of proving this fact is to insert a biquartz betweeen the Nicols. With a steady current it constitutes a sensitive detector of rotation, its sensitive tint turning green on one side and red on the other. But with this oscillatory current a biquartz does absolutely nothing. [Biquartz.]

That is one proof. Another is that rotating the analyzer either way weakens the extra brightening of the field, and weakens it equally either way.

But the most convincing proof is to reflect the light coming through the tube upon our rotating mirror, and to look now not at the spark, or not only at the spark, but at the faint band into which the last residue of light coming through polarizer and tube and analyzer is drawn out. [Analyze the light in rotating mirror.]

At every discharge this faint streak brightens in places into a beaded band: these are the oscillations of the polarized light: and when examined side by side they are as absolutely synchronous with the oscillations of the spark itself as can be perceived.

Out of a multitude of phenomena connected with the Leyden jar discharge I have selected a few only to present to you here this evening. Many more might have been shown, and great numbers more are not at present adapted for presentation to an audience, being only visible with difficulty and close to.

An old and trite subject is seen to have in the light of theory an unexpected charm and brilliancy. So it is with a great number of other old familiar facts at the present time.

The present is an epoch of astounding activity in physical science. Progress is a thing of months and weeks, almost of days. The long line of isolated ripples of past discovery seem blending into a mighty wave, on the crest of which one begins to discern some oncoming magnificent generalization. The suspense is becoming feverish, at times almost painful. One feels like a boy who has been long strumming on the silent keyboard of a deserted organ, into the chest of which an unseen power begins to blow a vivifying breath. Astonished, he now finds that the touch of a finger elicits a responsive note, and he hesitates, half delighted, half affrighted, lest he be deafened by the chords which it would seem he can now summon forth almost at will.

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[1] Most likely it was a conversation which I had with Sir Wm. Thomson, at Christmas, which caused me to see the interest of getting slow oscillations. My attention has mainly been directed to getting them quick.

ON THE LIMIT OF THE SOLAR SPECTRUM, THE BLUE OF THE SKY, AND THE FLUORESCENCE OF OZONE.

THERE are two facts of particular interest which have been observed in connection with the light which we receive from the sun and the sky. First, though the ultra-violet spectrum of the sun is very well represented by the iron spectrum taken from the electric arc, yet its length is nothing like so great, and there is no fading away of feeble lines and a weakening of strong ones, which would be the case if the rays were affected by a turbid medium through which they were transmitted, but there is a sudden and sharp extinction which points to a very definite absorption. Secondly, light from the clearest sky, unaffected by aqueous vapour, is of a deep and beautiful blue colour, more of an indigo-violet tint than ordinary so-called sky-blue. There is nothing more beautiful in Nature than the blueness of the heavens.

The limitation of the solar spectrum has been the subject of elaborate investigation by M. Cornu.[1] He proved by direct experiment that the ultra-violet rays are absorbed with energy by the atmosphere, and showed that there is a variation in the amount of absorption corresponding with different altitudes, so that the absorbent matter is at each elevation proportional to the barometric pressure, and consequently in constant relation to the mass of the atmosphere. This fact alone is sufficient to exclude water-vapour from consideration as being the medium of absorption. Moreover, water-vapour, while it absorbs the red and infra-red rays, transmits the ultra-violet very completely.

Photographs taken in 1879 on the Riffelberg, at an altitude therefore of 8414 feet, reached to wave-length 2932; but at Viège, an altitude of 2165 feet, to only 2954.

In short, it was shown that within the limits of altitude at which Cornu's observations were made there was a difference of 10 tenth-metrets of wave-length for every 984 feet of dry atmosphere, the shortening of the spectrum being due to the gaseous constituents. Notwithstanding this, it was stated by Prof. Liveing, in a lecture delivered at the Royal Institution on March 9, 1883, that we must suppose the absorbent substance, whatever it may be, is not in our atmosphere, because, when observations are made upon the summit of an elevation like the Riffelberg, the lengthening of the spectrum reaches only a very trifle beyond U. "The same reason will lead us to reject the notion that the absorption can be due to matter in interplanetary space, for it is not easy to suppose that the gases which pervade that space in extreme tenuity can differ much from those in our atmosphere, because the earth in its annual course must pick up whatever they are, and they must then diffuse into our atmosphere. The absorption is, therefore, probably neither in our atmosphere nor in interplanetary space, and we must look for it in the solar atmosphere."

It is then suggested that the blotting out of the sun's light beyond U is caused by something in the solar atmosphere higher up than the metallic vapours which give rise to Fraunhofer's lines, but at a lower temperature. It has been shown by Young that the Fraunhofer lines are bright lines, but appear black against the brilliant light of the photosphere. It never appeared to me that Prof. Liveing's objection to Cornu's explanation of the limitation of the solar spectrum by our atmosphere was valid, because it was proved beyond question that the atmosphere absorbs the ultra-violet rays, and also that on the same day and hour, at different elevations, the extent of rays absorbed was proportional to the barometric pressure—that is, to the quantity of air through which the rays passed. A considerable acquaintance with absorption-spectra in the ultra-violet region has proved to me that when an absorption-band has been blotted out by increasing the proportion of substance, or by increase of the thickness of the absorbent layer, a stage is soon reached at which any further increase only causes a trifling difference in absorbent action, and in fact that many substances attain a maximum of absorption beyond which there is no change unless we increase the density of the substance, and so probably alter its molecular structure. Under the same conditions of pressure, increased thickness of the absorbent layer only very slightly increases the absorbent action, and that in a degree which is by no means proportional to the layer of material.

There is a difficulty in accepting Prof. Liveing's views, because we know nothing, as he remarks, in the solar atmosphere capable of causing such absorption, and at the same time of transmitting the Fraunhofer lines of the less refrangible portions of the spectrum in the condition in which we observe them.

The matter was very fully considered by me two years previously—that is to say, in the year 1881. The absorption spectra of various gases were examined by photographing the ultra-violet rays which were transmitted by carefully measured quantities of gas at the atmospheric pressure, and one of these gases was ozone. It proved to be a substance with most extraordinary absorptive powers, so that even when very much diluted it exhibited an absorption-band of great intensity which was carefully investigated. By examining the spectrum transmitted by increasing quantities of ozone the band disappeared, and there was a complete and total absorption of rays extending to about wave-length 3160. Any further increase did not cause a corresponding shortening of the spectrum. The band was observed between wave-lengths about 2850 and 2320 but with increased proportions of ozone the rays transmitted were restricted to about 2920, and became more restricted in presence of greater quantities of gas.[1] Thus :—

Extreme ray transmitted by ozonized oxygen.		Length of column of gas traversed by the rays.		Actual volume of ozone per square centimetre of sectional area of column.
λ.		Centimetres.		Cubic centimetres.
3035	...	92	...	1·012
3150	...	196·5	...	2·162
3160	...	288·5	...	3·175

It was found that a quantity of ozone proportional to the average quantity present in a vertical column of the atmosphere caused an absorption similar to that observed in the solar spectrum—that is to say, terminating about 2950. Largely increased quantities did not largely, but only in a trifling degree, increase the absorption. Furthermore, it was shown that the atmosphere contained ozone as a normal constituent, and that it was present in greater proportion in the upper regions than near the earth's surface. It was proved that all the other minute constituents of the atmosphere were either non-absorbent or exerted absorption in a manner different from that of ozone, and that the quantity of ozone commonly present in the atmosphere is quite sufficient to account for the limitation of the solar spectrum, without taking into account the possible absorption caused by the great thickness of oxygen and of nitrogen. The possibility of oxygen being the absorptive substance seemed very great, considering the small difference in constitution between the molecules of ozone and oxygen. It must be understood that the conclusions were arrived at by reasoning from strictly quantitative experiments, and seemed almost incontrovertible, and it may be stated that none of the facts alleged have ever been questioned. It was impossible to deal with the matter further without costly appliances for the compression of oxygen and nitrogen into tubes capable of holding a quantity comparable with the amount of oxygen and of nitrogen in a vertical column of the atmosphere, and for this reason the investigation fell into abeyance.

It was also considered that the problem might be attacked in another manner.

Messrs. Liveing and Dewar have recently made a very interesting and important communication to the *Chemical News* (vol. lviii. p. 163), on the absorption-spectrum of oxygen. In a tube 1·6 metre in length, filled with the gas at a pressure of 160 atmospheres, all rays were absorbed beyond wave-length 2665, but they began to diminish at 2705. With a tube 6 metres or 20 feet long, and with a pressure of 90 atmospheres, it seems that an absorption-band is to be traced at wave-length 3640 to 3600, and there is a complete absorption beyond 3360.

The gas seen in quantity corresponding to that in a vertical column of the atmosphere appears to have a faint blue tint. There can be no doubt whatever that the oxygen of the air exerts a powerful absorption on the rays of the sun, but it does not appear from these experiments that this absorption is exactly the cause of the limitation of the spectrum, as described by Cornu, since when observed in tubes it is carried into a region of longer wave-length than is observed at the level of the sea; thus at Dublin the limit in summer is usually about 3130.[2] It is no doubt the high density of the gas which causes the absorption to be stronger than that of the atmosphere. It should be noted that the oxygen in the 20-foot tube was the quantity in a vertical column of the atmosphere. It is probable that there are several substances in interplanetary space, or in the solar atmosphere, which, besides oxygen and ozone in the air, cause an absorption of the sun's rays and a limitation of the length of the spectrum, but as Messrs. Liveing and Dewar point out, our atmosphere places a limit to the observations we can make on the rays of other heavenly bodies.

Touching the colour of the sky, Prof. Tyndall has told us that four centuries ago it was believed that the floating particles in the atmosphere render it a turbid medium through which we look at the darkness of space. The blue colour, according to his view, is supposed to be caused by reflection from minute particles, which can reflect chiefly the blue rays by reason of their small size. Experiments on highly attenuated vapours during condensation to cloudy matter were the basis of this reasoning. It always seemed to me that if a view be seen through a turbid medium which reflects chiefly the blue rays, it would not appear blue, but the complementary colour, yellow; and therefore this theory could not account for the blue of distance. In fact, when a light mist hangs over the surface of the earth, and the rays of the sun are transmitted in a direction approaching the horizontal, the result is that the sun and all objects lying in the direction looking towards it appear yellow, while the mist in the opposite direction appears blue, and only translucent, not transparent. The blue of the sky, if caused by such a similar action of floating particles, would not be seen when the sun was overhead, nor could it be seen by looking in the direction of the sun.

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[1] "Sur l'Absorption Atmosphérique des Radiations ultra-violettes," *Journ. de Physique*, t. x. 1881.

[1] "On the Absorption-Spectrum of Ozone, and on the Absorption of Solar Rays by Atmospheric Ozone," Journ. Chem. Soc. 1881, xxxix., pp. 57, 111, 119.

[2] In the *Phil. Mag.*, September 1888, p. 288, Messrs. Liveing and Dewar refer only to my first paper on the absorption-spectrum of ozone, Journ. Chem. Soc., xxxix, p. 57, but not to the more complete paper on this spectrum at pp. 111–119, *loc. cit.*, which indicates the possible limits of the ozone in the atmosphere.

The blue would not be transparent and in character similar to the blue of a clear distance, in which the outlines of mountains and rocks are perfectly distinct and sharp, the shadows being of an intensely deep blue, and the most distant objects the deepest in colour. In 1880, Messrs. Hautefeuille and Chappuis liquefied ozone, and found that its colour was indigo blue (*Comptes rendus*, xcv. p. 522). On December 12, 1880, M. Chappuis presented the Academy of Sciences of Paris with a paper on the visible spectrum of ozone. He recognized the most easily visible of the absorption-bands of ozone in the solar spectrum, and in consequence he stated that a theory of the blue colour of the sky could not be established without taking into account the presence of ozone in the atmosphere, for the luminous rays which reach us will of necessity be coloured blue by their transmission through the ozone contained in the atmosphere. And since ozone is an important constituent of the upper atmosphere, its blue colour certainly plays an important part in the colour of the sky. In March 1881, quantitative experiments made by me were published to show how much of blueness could be communicated to layers of gas of different thicknesses when given volumes of ozone are present. I showed that ozone is a normal constituent in the upper atmosphere, that it is commonly present in fresh air, and I accounted for its abundance during the prevalence of westerly and south-westerly winds. It was likewise shown that it was impossible to pass rays of light through as much as 5 miles of air without the rays being coloured sky-blue by the ozone commonly present, and that the blue of objects viewed on a clear day at greater distances up to 35 or 50 miles must be almost entirely the blueness of ozone in the air. The quantity of ozone giving a full sky-blue tint in a tube only 2 feet in length is 2½ milligrammes in each square centimetre of sectional area of the tube. It is necessary to mention that a theory of the blue of the sky was propounded by M. Lallemand ("Sur la Polarisation et la Fluorescence de l'Atmosphère," *Comptes rendus*, lxxv. p. 707, 1872) after his observations had been found inconsistent with all previous explanations. If the coloration be due to reflection from minute particles of floating matter, or if it be due to white light being transmitted through a blue gas, the blue portion of the sky should be polarized quite as much as white light coming from the same direction in the heavens. But the experiments of M. Lallemand prove that this is not so. Upon these experiments he bases his theory that the blue colour of the atmosphere is due to a blue fluorescence like that seen in acid solutions of sulphate of quinine—that is to say, caused by a change of refrangibility in the ultra-violet rays.

Ångström first threw out the idea of fluorescence being a property of certain gases in the atmosphere. To possess this property the gas must be capable of absorbing either in part or entirely the ultra-violet and violet rays, and of emitting them with a lowered refrangibility and without being polarized. Ozone possesses the property of absorption in the highest degree in the ultra-violet region, and I have now to announce that strongly ozonized oxygen is highly fluorescent when seen in a glass bottle two inches in diameter illuminated by an electric spark passing between cadmium electrodes. The colour of the fluorescence is a beautiful steel blue. This fluorescence has not been observed in other gases, but it is in the highest degree probable that oxygen is fluorescent, though this has yet to be proved. There can be, however, little doubt that the colour of the sky is caused in part by the fluorescence of ozone, and also to some extent by the transmission of rays through the blue gas. The blue of distance is doubtless to be attributed more to transmission than the blue of the sky, though it is quite conceivable that fluorescence also here comes into play. Whatever other cause concurs in the production of the blue of the heavens, it has certainly been established by M. Chappuis that the properties of ozone participate in its production.

In August 1884, a very short note was sent by me to NATURE concerning the red solar halo seen at Zermatt and on the Riffelberg with great distinctness. I recorded the occurrence of a dark band in the spectrum, slightly more refrangible than D, which was seen to vary in intensity; a second band a little less refrangible than D was also observed. On account of the altitude at which the observations were made, viz. 9000 feet, and the state of the weather at the time, these bands were considered to be due to some constituent of dry air.

The subject of the telluric rays has become of increased interest since M. Cornu has studied the dark lines in the neighbourhood of D, but unfortunately the rays absorbed to which I refer are both a little more and a little less refrangible than those figured on his map of this region. If we accept the number 5890 tenth-metres as approximately representing the mean value of the lines D^1 D^2, the narrow bands observed by me have wave-lengths about (1) 5950 and (2) 5770 at their darkest parts, as far as one can ascertain with a hand spectroscope giving excellent definition but small dispersion. They are very variable, being dependent on the state of the weather, and are more distinct and broader when viewed with the sun on the horizon. In London during the dry calm weather of June and July 1884, they were very strong, but variable in different parts of the sky.

The less refrangible band, or broad line as it usually appears, below D, is generally over-lapped by a band belonging to water vapour, the chief "rain-band." On this account observations at an elevation of 10,000 feet or so during perfectly dry weather were considered of interest. The bands were observed against the blue sky on several occasions, but they were also at other times entirely absent or barely visible. There is some liability to a group of iron, barium, and other solar lines being mistaken for the more refrangible band when it is not decidedly strong. Chappuis observed bands in the blue sky coincident with ozone bands, and I have on that account always expected to find some indication of the spectrum of ozone in the upper atmosphere, but the reason why there must always be a difficulty in obtaining evidence of any absorption due to this substance arises from the strongest visible band of ozone, with wave-length 6095 to 5935, being masked by the band of water vapour; and secondly, because the total amount of white light so preponderates as to overpower the effect of absorption—that is to say, the rays absorbed are only a small fraction of those transmitted, so that the bands are faint and the colour due to absorption is either not seen or seen only with difficulty. Owing to this fact we cannot distinguish the blue colour of the clouds when the sunlight is bright; but when the sky is completely over-clouded with cumuli a faintly bluish tint is given to the cloud-shadows, even at the zenith. Near the horizon not only are the bright parts of the clouds blue, but their shadows have a rich blue tint.[1] The blueness varies somewhat: at times it may be seen to shift about in the sky; it has been observed, for instance, to pass over from south-west to north-east. The second but less conspicuous band of ozone absorbs rays with wave-length 5770 to 5600. Both bands have been observed in a dry atmosphere at elevations varying from 6000 to 10,000 feet, both in the blue of the sky and against white clouds. The measurements, very imperfectly made under difficulties, showed them to have wave-lengths about (1) 5950, (2) 5770, in the centre of the dark portion, while, according to Chappuis, the bands of ozone are—

(1) 6095 to 5935 ... mean, 6010
(2) 5770 to 5600 ... mean, 5680.

On Ångström's chart, a dark band, diminishing in depth towards the east, extends from 5785 to 5680, which is classed among the *raies atmosphériques*; this is similar to the band observed by me when viewing the sun or bright clouds near the horizon, and is similar to the second ozone band.

The work of Prof. Piazzi-Smyth, "Madeira Spectroscopic," does not give that portion of the spectrum which would serve for comparison. The "low-sun band," δ, comes very near to band (2), wave-length 5770, while the "rain-band" comes very near (1), 6095. On several subsequent occasions the two bands were observed at lower levels than Zermatt and the Riffel, but with even less intensity. On the last occasion (November 10, 1884) that such an observation was recorded, there was only a trace of these faintly seen. No doubt a clear atmosphere, free from the turbidity so easily created by condensing moisture, is essential to their visibility. Schœne has observed bands in a bright sky before sunrise and after sunset, during an intense frost in Central Russia. The measurements taken identified them with ozone bands, and leave scarcely any doubt whatever of the presence of ozone in the atmosphere, and if it can be so recognized, it must communicate its characteristic blue colour to the air (Journ. Chem. Soc. Abstracts, vol. xlviii. part 2, p. 713). The remarkable crepuscular phenomena seen at the close of 1883 proved highly favourable to such investigations.

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[1] Prof. Pickering has proved that sunlight as it reaches us is blue, which must be the case if it has passed through a blue medium (Proc. American Academy of Sciences, 1880, p. 236).

In order to continue a series of observations on the solar spectrum near D it would be best to employ a fairly good dispersion and large lenses with long focus admitting a large amount of light to the eye, or, better still, to specially prepared photographic plates highly sensitive to the yellow rays.

The very extensive absorption of the ultra-violet rays by oxygen leads us to expect it to be fluorescent. All such absorbents are fluorescent more or less, and generally strongly, but when the absorbed rays are of very short wave-length the fluorescence is not always visible. Thus there are many substances which do not appear fluorescent by lime-light nor by dull daylight, but are strongly so when seen by electric light, especially if it has passed through no glass or other medium than a quartz lens and a short column of air. Some substances are not fluorescent when seen in glass vessels, because the glass has absorbed those rays of which the refrangibility would have been lowered by the fluorescent substance. In air, and by the light of an electric spark rich in ultra-violet rays, such as that from cadmium electrodes, almost everything is fluorescent. The whole range of the cadmium spectrum has been viewed by me, owing to the fluorescence of the purest white blotting-paper. The light, of course, is feeble, and the eye has to be trained to make observations in total darkness.

Pure water, however, never appears fluorescent. Some solutions in water, which transmit all the ultra-violet rays as far as 2304, are fluorescent, though whether this is caused by impurities or not has not been decided.

It cannot any longer be doubted (1) that the extreme limit of the solar spectrum observed by Cornu is caused by the gases in the atmosphere, probably both by oxygen and ozone; (2) that the blue of the sky is a phenomenon caused by the fluorescence of the gaseous constituents of the atmosphere, and probably ozone and oxygen are the chief fluorescent substances; (3) that ozone is generally present in the air in sufficient quantity to render its characteristic absorption-spectrum visible, and that therefore it gives a blue colour to the atmosphere by absorption, through which blue medium we observe distant views; (4) that water vapour does not participate in the coloration of the atmosphere under like conditions and in the same manner as ozone. W. N. HARTLEY.

Royal College of Science, Dublin.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Vice-Chancellor of Cambridge University publishes the following:—

"*Ferndene, Gateshead, March* 4, 1889.

"SIR,—You may be aware that some years ago I erected here a refracting telescope, 25-inch aperture and 30 feet focal length.

"Owing to unfavourable atmospheric conditions and other reasons, the instrument has done no systematic work in its present position. I should much like to place it where it would work under capable direction.

"I contemplate offering my telescope and the dome and instruments connected with it to the University of Cambridge. The part that the University has taken of late years in the advancement of science induces me to hope that the possession of an instrument especially adapted to the study of stellar physics may give impetus to the development of the subject.

"I beg you therefore to give the matter consideration, and let me know what proposals can be made to insure proper use and maintenance of the instruments, and publication of yearly reports, in case my offer is acceptable to the University.

"I have the honour to be, Sir,
"Your obedient Servant,
"R. S. NEWALL.

"The Vice-Chancellor of the University of Cambridge."

At the Congregation to-day, at 2 p.m., the following Grace, having received the sanction of the Council, is to be offered to the Senate:—

"That the Vice-Chancellor, Dr. Routh, Dr. Glaisher, Prof. Adams, Prof. Liveing, Prof. Darwin, and Prof. Thomson, be appointed a Syndicate to consider Mr. R. S. Newall's munificent proposal to present his telescope to the University, and the arrangements and expenditure which would be necessary to maintain and utilize it for astronomical and physical research, and to report to the Senate."

SCIENTIFIC SERIALS.

IN the *Journal of Botany* for February and March, Mr. A. Fryer continues his notes on pond-weeds, the present instalment being characterized by two plates and the description of a new species, *Potamogeton falcatus*, from Huntingdonshire. Another addition to the British flora is recorded by the Rev. E. S. Marshall, in *Festuca heterophylla*, from Witley, in Surrey; and Mr. F. J. Hanbury describes no less than four species or sub-species of the difficult genus, *Hieracium*, new to science—all from the extreme north of Scotland. Messrs. G. Murray and L. A. Boodle commence a monograph of *Avrainvillea*, a genus of siphonocladaceous Algæ, which they consider most nearly allied to *Penicillus* and *Udotea*.

THE *Botanical Gazette* for January contains a short description and history, illustrated by five plates, of the new Botanical Laboratory at the University of Philadelphia. The occurrence of a new phosphorescent Fungus is noted, *Agaricus* (*Clitocybe*) *illudens*, in which the phosphorescence appears to reside in the hymenium. In the number for February, Dr. Henrietta E. Hooker gives a highly interesting description of the structure and mode of life of the common dodder of Massachusetts, *Cuscuta Gronovii*. It is stated to have a habit of entirely withdrawing its roots from the soil by the contraction of the coils of its twining stem as soon as it commences to lead a parasitic life on its host. Miss Emily L. Gregory continues her paper on the "Development of cork-wings on certain trees."

Rivista Scientifico-Industriale, January 31.—On the oxalate of lime in plants, by Prof. Aser Poli. In these remarks, which are made in connection with C. Acqua's recent contribution to the study of the crystals of the oxalate of lime in plants, it is argued that even on Acqua's own showing, the presence of these crystals cannot be regarded as necessary to the life of the plant. In some they are not found at all, and where they do exist they seem to be rather an inevitable consequence of the production of oxalic acid in the presence of the salts of lime.—Prof. Ercole Fossati continues, without concluding, his elaborate monograph on the thermic and electric properties of iron subjected to magnetic influences.

Bulletin de la Société des Naturalistes de Moscou, 1888, No. 3.—On the peculiarities of the skulls of the horned cattle of the Kalmucks, by P. Kuleschoff (in German), with photographs of skulls. The great likeness between the skulls of the Kalmuck race of horned cattle and those of *Bos sondaicus* and the zebra brings the author to the conclusion that the ancestors of the European cattle must be searched for in India.—On the Orthopteres of Crimea, by O. Retowski (with three plates).—On the structure of the pseudo-scorpions, or *Chernetidæ*, by A. Croneberg (both in German). The differences in the structure of this group and that of the scorpions proper are pointed out, and Thorell's views on the affinities of the *Chernetidæ* are confirmed.—Review of the generative organs of the *Pompilidæ*, by General Radoszkowski (in French, with four plates).—Supplementary note on the great comet 1887 I., by Th. Bredichin (in French). It belongs to the author's third class of comets—that is, it consists of heavy elements; and more accurate calculations convince the author that it could consist only of elements having a great molecular weight, such as gold, mercury, and lead.—Some additions to the flora of Moscow, by S. Milutin.